

## **Steam Sterilization Surveillance – Development and Thermodynamic Modelling of an IoT Steam Sterilization Procedure Counter**

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To ensure that no pathogens will be transferred during a surgery, all medical instruments need to be completely sterile. In the case of reusable instruments, this is achieved by a complex sterilization procedure. Due to the importance of this process, this study aims for the development of a compact sensor system, which can be placed inside a medical sterile container, detecting a successful steam sterilization. This shall be achieved by measuring the applied temperature profile close to the surgical instruments. The design of the sensor system requires a deep analysis of the effect of the system's insulation to the on-board temperature sensor. To achieve this, a thermodynamic model was developed. To verify the model's parameter, simulated temperature profiles were compared with measured values of the same applied profile. This iterative development led to an improvement of the simulation parameters as well as for the algorithm of automated evaluation of the sterilization process. In the study we show that the developed thermodynamic model can be used for a reliable evaluation of the sensor system and further, that an autonomous detection of sterilization cycles can be achieved. However, further studies addressing optimizations in terms of geometrical dimensions, used materials, and processing algorithms need to be carried out due to the limitations given by the required adaptation to currently used medical sterile containers.